



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification <sup>5</sup> : <b>B65D 81/00</b></p>	<p><b>A1</b></p>	<p>(11) International Publication Number: <b>WO 93/17932</b></p> <p>(43) International Publication Date: 16 September 1993 (16.09.93)</p>
<p>(21) International Application Number: PCT/EP93/00465</p> <p>(22) International Filing Date: 2 March 1993 (02.03.93)</p> <p>(30) Priority data: TO92A000180 4 March 1992 (04.03.92) IT</p> <p>(71) Applicant (for all designated States except US): LUIGI LA-VAZZA S.P.A. [IT/IT]; Corso Novara, 59, I-10154 Torino (IT).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only) : CORDONE, Carlo [IT/IT]; Corso Garibaldi, 22, I-20121 Milano (IT).</p> <p>(74) Agents: SACONNEY, Piero et al.; Jacobacci-Casetta &amp; Perani S.p.A., Via Alfieri, 17, I-10121 Torino (IT).</p>		<p>(81) Designated States: AU, BB, BG, BR, CA, CZ, FI, HU, JP, KP, KR, LK, MG, MN, MW, NO, NZ, PL, RO, RU, SD, SK, UA, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, SN, TD, TG).</p> <p><b>Published</b> With international search report.</p>
<p>(54) Title: A DISPOSABLE CARTRIDGE FOR USE IN MACHINES FOR EXTRACTION AND DISPENSING OF HOT DRINKS</p>		
<p>(57) Abstract</p> <p>An inlet end wall of the cartridge has an outer peripheral annular rib (26) which surrounds a perforated region (20) and can be engaged under mechanical pressure by a heated plate (P) for introducing hot water into the cartridge. The annular rib (26) is made of a plastics material, such as polypropylene, which can be softened at the temperature to which the water delivery plate (p) is heated.</p>		

A DISPOSABLE CARTRIDGE FOR USE IN MACHINES FOR  
EXTRACTION AND DISPENSING OF HOT DRINKS

The present invention relates to a disposable cartridge comprising a substantially rigid casing which contains a portion of powder, granular or like particulate material for producing a drink by percolation, dissolution or infusion with hot water under pressure, in which the casing comprises a cylindrical, substantially hollow body which includes an imperforate side wall, an inlet end wall having a perforated central region and a perforated opposite outlet end wall, and in which the inlet end wall has an outer peripheral annular rib which surrounds the perforated region and can be engaged under mechanical pressure by a heated plate for introducing hot water under hydraulic pressure into the cartridge through the said central region to produce the drink and dispense it through the outlet end wall.

Cartridges of this general type are known from, among others, document EP-A-0 057 671.

The peripheral annular rib serves as a kind of seal cooperating with the delivery outlet plate of the machine so as peripherally to contain the hot water under pressure which is introduced into the cartridge through

the perforated region of its upper wall from the centre of the delivery plate.

Given that the pressure of the hot water delivered by the delivery plate is of the order of 10-15 bar, it is desirable that the plate should press on the annular rib and couple with this in a precise manner to prevent hot water from leaking peripherally before reaching the interior of the cartridge.

However, it often happens that this coupling is not perfect due to the fact that the plate and the top of the rib are not coplanar.

The object of the present invention is to provide a cartridge of the type discussed above in which a perfect sealing coupling between the plate and the annular rib will be guaranteed even in the event that the two parts are not coplanar.

According to the invention this object is achieved by means of a cartridge of the type described above, characterised in that the said annular rib is made from a plastics material which is softenable at the temperature to which the water delivery plate is heated.

Preferably the rib has an annular crest which can be

flattened under the mechanical pressure of the delivery plate after softening of the plastics material.

In the preferred embodiment the rib has a frusto-conical face the vertex of which coincides with the axis of the cartridge and which has an obtuse vertex angle, as well as a radially outer surface forming, with the frusto-conical face, the said flattenable annular crest.

With this arrangement the deformation of the rib under the effect of the heat accommodates all defects due to the rib and the plate not being coplanar, thus guaranteeing a perfect water tight seal under pressure.

In the preferred embodiment the face of the rib has a very shallow inclination towards the centre of the upper wall: gradually as the annular crest softens the plate is able to press on a surface of the rib which rapidly grows as the plate descends and with a corresponding rapid reduction in the specific mechanical pressure on the upper surface of the rib. With this reduction in specific pressure corresponds a gradually decreasing softening of the plastics material, and deformation of the rib is finally stopped without the rib becoming entirely softened.

The object of the invention will be understood better

from a reading of the following detailed description of a preferred embodiment, given by way non-limitative example and illustrated in the attached drawings.

In the drawings:

Figure 1 is a perspective view of a cartridge provided with an annular rib according to the invention;

Figure 2 is a diametral section on an enlarged scale of the same cartridge;

Figure 3 is a partial section, further enlarged, of the region enclosed by the circle III in Figure 2; and

Figure 4 is a partial section corresponding to that of Figure 3, in which a part of a water delivery plate pressed on the annular rib is schematically shown, with the rib having been deformed by the effect of the heat and the mechanical pressure exerted by the plate.

Referring now to Figures 1 and 2, a disposable cartridge comprises a hollow body or casing, generally indicated 10. The hollow body 10 has a substantially cylindrical form and is able to contain a portion of a granular, powder or particulate material M (Figure 2) able to produce a drink by percolation, dissolution or infusion with hot water under pressure. As far as the machine for use of the cartridge is concerned, reference is made for example to document EP-A-O 041 031 which relates to an automatic coffee machine capable of utilising a cartridge

such as that described and illustrated in the attached drawings.

The hollow body 10 includes a cup-shaped part, generally indicated 12, and a part constituting a cover, generally indicated 14. Both the parts 12 and 14 can be made economically in substantially rigid plastics material suitable for use with foods. The use of a plastics material is not however limitative except for the characteristics which will be described further below.

A convenient material for producing the parts 12 and 14 is a polypropylene which, in order to achieve the objects of the invention which will be discussed, has a softening temperature around 100°C.

The cup-shaped part 12 includes an imperforate substantially cylindrical side wall 16 which constitutes the side wall of the casing 10, and a bottom wall 18 which constitutes an outlet end wall of the casing 10. The bottom wall 18 is surrounded by an annular rib 19 which serves to form a seal on a lower plate or like element on which the cartridge can be supported by its lower wall.

The bottom wall 18 is perforated and can have a plurality of holes, as illustrated for example in document EP-A-0

041 931, or a single central hole, as described and illustrated in document EP-A-0 057 671.

The cover 14 includes a perforated circular central region 20 which constitutes an inlet end wall of the casing 10. The central region 20 is surrounded outwardly by a peripheral annular flange 22 coupled to a corresponding annular flange 24 formed integrally with the upper edge of the side wall 16 of the cup-shaped part 12.

The central region 20 can have a plurality of holes, as shown, or other apertures, or one or more peripheral holes as in document EP-A-0 057 671 to which reference is made.

The outer face of the perforated central region 20 of the cover 14 is surrounded by an outer peripheral annular rib 26 the function of which will now be explained with reference to Figures 3 and 4.

Referring to Figure 3, the outer peripheral annular rib 26 which surrounds the perforated central region 20 of the inlet end wall has a frusto-conical face 28 the vertex of which is coincident with the axis of the cartridge. The vertex angle of the frusto-conical face 28 is obtuse. This vertex angle is preferably almost flat, with a value

of the order of  $175^{\circ}$ .

The annular rib 26 is delimited by a radially outer surface 30 which forms, with the frusto conical face 28, a circular crest or annular apex 32. Preferably, at least in the region of the annular apex 32, the front face 28 and radially outer face 30 form between them an angle equal to about  $90^{\circ}$ .

A preferred material at least for the rib 26 and preferably for the whole of the body 10 is a food grade polypropylene having a softening point slightly less than the temperature of boiling water, but a melting point higher than the temperature of boiling water (for example  $110^{\circ}\text{C}$ ).

In Figure 4 the reference letter P indicates a metal plate which forms part of a coffee machine or other machine for the extraction of a drink starting from the material M (Figure 2) contained in the cartridge. The machine can be of the type described and illustrated in document EP-A-0 041 031.

The plate P has a central hole for the delivery of hot water, for example at a temperature of  $90^{\circ}\text{C}$  and at a pressure between 10 and 15 bar.



For delivery of hot water under pressure the plate P has been lowered or otherwise pressed in the direction of the arrow F onto the annular rib 26. The temperature of the plate P is substantially equal to that of the hot water, that is to say of the order of 90°C.

Under the mechanical pressure exerted in the direction of the arrow F the plate P has softened and deformed first the annular apex 32 and then, partially, the upper part of the rib 26.

In Figure 4 reference numeral 26a represents the integral part of the rib 26 before softening and the reference 26b indicates the bulge deriving from the softened part 28a underlying the apex 32. As can be seen, the flat pressure surface S of the plate P has largely transformed the initially frusto-conical face 28 into a flat face 28a which seals against the surface S of the plate P thus guaranteeing an hermetic seal against the escape of hot water under pressure from the space, indicated 32, lying between the perforated central region 20 of the cover 14 and the corresponding central region of the plate P.

The plastics material of the annular rib 26, softened and deformed under the effect of the heat does not melt due to the fact that its temperature does not exceed about 100°C which is the temperature of the water introduced

into the cartridge. It remains in what may be called a "rubbery" state and in this state behaves practically as a resilient seal to the advantage of the sealing effect.

As can be seen in Figure 4, the contact interface between the plate P and the rib 26, corresponding to the reference 28a, obtained by the thermal deformation of the plastics material of the apex 32 and the remaining part of the rib 26, occupies a major part of the initially frusto-conical surface thus guaranteeing a specific mechanical pressure in the direction of the arrow F such as not to cause complete softening of the rib 26 which would give rise to the loss of the sealing effect.

CLAIMS

1. A disposable cartridge comprising a substantially rigid casing (10) which contains a portion of granular, powder or like particulate material (M) for producing a drink by percolation, dissolution or infusion with hot water under pressure, in which the casing consists of a substantially cylindrical hollow body (10) which includes an imperforate side wall (16), an inlet end wall having a perforated central region and an opposite, perforated outlet end wall (18), and in which the inlet end wall has an outer peripheral annular rib (26) which surrounds the perforated region (20) and can be engaged under mechanical pressure by a heated plate (P) for introduction of hot water under hydraulic pressure into the cartridge through the said central region (20) for production of the drink and its delivery through the outlet end wall (18), characterised in that the said annular rib (26) is made of a plastics material which can be softened at the temperature to which the delivery plate (P) is heated.

2. A cartridge according to Claim 1, characterised in that the face of the rib (26) has an annular crest (32) flattenable, due to the softening effect of the plastics material, under the mechanical pressure of the delivery

plate (P).

3. A cartridge according to Claim 2, characterised in that the rib (26) has a frusto-conical face (28) the vertex of which lies on the axis of the cartridge and has an obtuse vertex angle, and a radially outer surface (30) forming, with the frusto-conical front face (28), the said flattenable annular crest (32).

4. A cartridge according to Claim 3, characterised in that the obtuse vertex angle of the frusto-conical front face (28) is of the order of  $175^{\circ}$ .

5. A cartridge according to Claim 3 or Claim 4, characterised in that at least in the region of the flattenable annular crest (32) the said frusto-conical front face (28) and radially outer face (30) form between them an angle of or close to  $90^{\circ}$ .

6. A cartridge according to any preceding claim, characterised in that the material of the rib (26) is polypropylene having a softening point less than the temperature of boiling water and a melting point greater than that of boiling water.



## INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 93/00465

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>6</sup>		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int.Cl. 5 B65D81/00		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>7</sup>		
Classification System	Classification Symbols	
Int.Cl. 5	B65D	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup>		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup></b>		
Category <sup>10</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
A	FR,A,2 041 380 (SEB) 29 January 1971 see claims 1,8; figure 6 ---	1
A	EP,A,0 057 671 (UNOPER) 11 August 1982 cited in the application -----	
<p><sup>10</sup> Special categories of cited documents : <sup>10</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search		Date of Mailing of this International Search Report
21 JUNE 1993		21 JUN 93
International Searching Authority		Signature of Authorized Officer
EUROPEAN PATENT OFFICE		BESSY M.J.F.M.G.

**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO.**

EP 9300465  
SA 70925

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.  
The members are as contained in the European Patent Office EDP file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information. 21/06/93

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR-A-2041380	29-01-71	None	
EP-A-0057671	11-08-82	AT-T- 10160	15-11-84
		US-A- 4471689	18-09-84